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**Biochem-Fall 2011**

***Note: I wrote up these questions using our lecture slides from last year. While they are very similar—and often identical—to the ones used this year, some may very slightly (i.e. Dr. Eisenmann taught the cell structure/function lecture this year, while Dr. Cicila did it last year)…so a couple of the questions on here might not have been covered in your lectures. If you find any errors, please let me know.***

**Practice Test for Exam One**

1. What is the approximate resolving power of a light microscope?
   1. 0.02 µm
   2. 0.2 µm
   3. 20 µm
   4. 200 µm
   5. 1 cm
2. Which of these organelles uses enzymes in the cytochrome P450 family to help detoxify drugs?
   1. Smooth Endoplasmic Reticulum
   2. Rough Endoplasmic Reticulum
   3. Mitochondria
   4. Lysosomes
   5. Peroxisomes
3. Which statement is true about the functions of mitochondria and peroxisomes?
   1. Mitochondria utilize oxygen, but peroxisomes do not.
   2. Peroxisomes utilize oxygen, but mitochondria do not.
   3. Both mitochondria and peroxisomes utilize oxygen.
   4. Neither mitochondria nor peroxisomes utilize oxygen.
4. Selected proteins are transported from the cytosol to the mitochondria using
   1. Gated transport.
   2. Transmembrane transport.
   3. Vesicular transport.
   4. None of the above.
5. Choose the correct statement about apoptosis and necrosis.
   1. Chromatin condensation is characteristic of apoptosis.
   2. In both necrosis and apoptosis, macrophages engulf the contents of the cells.
   3. Necrosis is the organized breakdown of tissue in multi-cellular organisms.
   4. Apoptosis is usually the result of cell injury.
   5. Necrosis will never trigger an immune response.
6. Which of these bonds is the strongest?
   1. Ionic bonds
   2. Hydrogen bonds
   3. Covalent bonds
   4. Van der Waals interactions
   5. There is no significant difference in the strengths of these bonds.
7. The hydrophobic effect describes the aggregation of \_\_\_\_\_\_ molecules in water, which leads to a/an \_\_\_\_\_\_ of free energy and a subsequent \_\_\_\_\_\_ in entropy.
   1. Polar; release; increase
   2. Nonpolar; release; decrease
   3. Polar; absorption; increase
   4. Nonpolar; absorption; decrease
   5. Nonpolar; release; increase
8. Consider a weak acid HA with Ka=1x10-6. If [HA]=[A-], what is the pH of the solution?
   1. 10-6
   2. 10
   3. 6
   4. 0.001
   5. 0.06
9. Which of these groups is/are present in an amino acid at pH 7.4?
   1. NH3+ and COO-
   2. NH2 and COO-
   3. NH3+ and COOH
   4. NH2 and COOH
   5. COO- only
10. What is the only achiral amino acid?
    1. Leucine
    2. Proline
    3. Serine
    4. Valine
    5. Glycine
11. Which statement is true regarding peripheral membrane proteins?
    1. They are more tightly associated with the membrane than integral proteins.
    2. They can be removed with salt.
    3. They span the hydrophobic core of the membrane.
    4. They cannot be removed by altering the pH.
    5. They are present only on the exoplasmic face of the lipid bilayer.
12. What erythrocyte integral membrane glycoprotein is the basis for the MN blood group?
    1. Spectrin
    2. Ankyrin
    3. Band 4.1
    4. Glycophorin
    5. Fibronectin
13. Which of these fatty acids would be expected to have the highest melting temperature?
    1. Stearate (18-carbon chain, 0 double bonds)
    2. Oleate (18-carbon chain, 1 double bond)
    3. Laurate (12-carbon chain, 0 double bonds)
    4. Palmitate (16-carbon chain, 0 double bonds)
    5. Linoleate (18-carbon chain, 2 double bonds)
14. In proteins, all bonds except peptide bonds are described by angles of rotation. For instance, psi (ψ) is the angle of rotation between
    1. The carbon atom of the carbonyl group and the nitrogen atom of the amino group.
    2. The oxygen atom of the carbonyl group and the alpha carbon
    3. The alpha carbon and the carbon atom of the carbonyl group
    4. The hydrogen atom of the amino group and the alpha carbon
    5. The nitrogen atom of the amino group and the alpha carbon
15. What is the approximate molecular weight of a protein that consists of 20 amino acids? Note: D=daltons
    1. 2.2 kD
    2. 220 daltons
    3. 22000 daltons
    4. 220 kD
    5. 2200 kD
16. What is the primary protein subunit of microfilaments?
    1. Actin
    2. Tubulin
    3. Nexin
    4. Spectrin
    5. Dystrophin
17. Several proteins play a role in the assembly and disassembly of actin filaments. For instance, \_\_\_\_\_\_\_\_ is responsible for blocking the (-) end, thereby inhibiting filament dissaessembly.
    1. Profilin
    2. Cofilin
    3. CapZ
    4. Tropomodulin
    5. Gelsolin
18. Which statement about microtubules is false?
    1. The primary protein subunit is tubulin.
    2. They have GTPase activity.
    3. Their structures consist of tetramers of α and β subunits.
    4. Subunits are added more rapidly at the (+) end than at the (-) end.
    5. The general cytoplasmic structure consists of 13 protofilaments.
19. Which of these is a drug that binds to tubulin and leads to microtubule depolymerization?
    1. Taxol
    2. Vinblastine
    3. Vincristine
    4. Oubain
    5. Colchicine
20. A nuclear pore complex (NPC) is composed of 3 rings. Which ring contains a transporter?
    1. Cytoplasmic
    2. Middle
    3. Nucleoplasmic
    4. All of the above
    5. None of the above
21. The GLUT4 protein is important for insulin-stimulated glucose uptake in adipose tissue and works via what mode of function?
    1. Primary active transport
    2. Secondary active transport
    3. Simple diffusion
    4. Facilitated diffusion
    5. An ion pump
22. Myasthenia Gravis is a disease resulting from an autoimmune response against what general class of membrane protein?
23. Ligand-gated ion channel
24. ABC-Type transporter
25. Facilitative transporter
26. Voltage-gated ion channel
27. P-type ATPase ion pump
28. Which statement is true regarding the Na+/K+ ATPase?
    1. It is inhibited by the drug Ouabain
    2. It is an example of an ABC-type transporter
    3. It works by secondary active transport
    4. Cardiotonic steroid drugs act on it by inhibiting phoosphorylation
    5. It does not require a cofactor to operate
29. Which of these values is within the range of average hemoglobin concentration in females?
    1. 8 g/dl
    2. 10 g/dl
    3. 13 g/dl
    4. 18 g/dl
    5. 25 g/dl
30. Changes in the quantity and quality or which of these proteins can lead to Hereditary Spherocytosis?
    1. Spectrin A
    2. Ankyrin
    3. Band 3
    4. Band 4.2
    5. Changes in any of the above proteins can lead to Hereditary Spherocytosis.
31. Which statement is true about precursor cells?
    1. They cannot divide
    2. They are directly produced by multipotential hematopoietic stem cells (MHSCs)
    3. They are capable of self-renewal
    4. They do not produce clones of mature cells
    5. They are pluripotent.
32. Which statement is true regarding B and T lymphocytes?
    1. B-lymphocytes are produced in the bone marrow, but T-lymphocytes are not.
    2. T-lymphocytes are produced in the bone marrow, but B-lymphocytes are not.
    3. Both B-lymphocytes and T-lymphocytes are produced in the bone marrow.
    4. Neither B-lymphocytes nor T-lymphocytes are produced in the bone marrow.
33. You are testing a patient for immunoglobin levels. The level of which immunoglobin should be the highest?
    1. IgG
    2. IgM
    3. IgA
    4. IgD
    5. IgE
34. Choose the correct statement about the embryological origin of epithelia.
    1. The epidermis derives from mesoderm.
    2. The mesothelium lines the blood, lymphatic vessels, and heart.
    3. The endoderm giver rise to the distal parts of the urogenital tract.
    4. The endothelium derives from the ectoderm.
    5. The mesoderm gives rise to the linings of the G.I. tract.
35. Most of the respiratory tract consists of what type of epithelial cells?
    1. Simple squamous
    2. Stratified cuboidal
    3. Simple columnar
    4. Pseudostratified columnar
    5. Stratified squamous
36. Choose the correct statement about multilaminar (stratified) epithelium.
    1. Keratinized stratified squamous epithelium contains no nuclei in the surface layers.
    2. The surface cells of distended transitional uroepithelium are cuboidal.
    3. The surface cells of non-distended transitional uroepithelium are squamous.
    4. The epidermis of the skin consists primarily of non-keratinized stratified squamous epithelium.
    5. Squamous epithelia are classified as such because the deeper (i.e. *not* surface) cells have that shape.
37. Which statement is false?
    1. The terminal web of microvilli consists of both actin *and* spectrin molecules?
    2. Size is the only structural difference between microvilli and stereocilia.
    3. Microvilli and stereocilia are two examples of surface modifications that help to carry out the function of basolateral surface.
    4. Cilia consist of an axoneme core in an arrangement of two singlets surrounded by nine doublets of microtubules.
    5. The actin filaments of microvilli are linked down their length by a protein called fimbrin.
38. Choose the correct statement.
    1. Kartagener’s Syndrome results from the absence of dynein.
    2. The zonula occludens is alsoknown as the adhesion belt.
    3. Phemphigus vulgaris is an autoimmune disease caused by the formation of antibodies to the cadherin desmocolin.
    4. Desmosomes use the transmembrane linker protein, integrin, to hold the adjacent cell membranes together.
    5. Connexons permit the passage of polysaccharides and nucleic acids.
39. Choose the correct statement about glands.
    1. Sweat glands can be classified as “simple branched alveolar.”
    2. Goblet cells are an example of multicellular glands.
    3. Holocrine secretion is a mode of secretion wherein the whole living cell is secreted.
    4. If one were classifying the sebaceous gland of the skin by type of secretion, the best term to use would be “holocrine.”
    5. Salivary glands serve as an example of both merocrine secretion *and* mixed glands.
40. Column chromatography is a method for discriminating proteins based on
    1. Charge
    2. Size
    3. Binding affinity
    4. Solubility
    5. pH
41. What is the best method of protein purification, as it allows one to dramatically increase protein yield?
    1. Column chromatography
    2. Affinity chromatography
    3. Gel electrophoresis
    4. Dialysis
    5. SDS-PAGE
42. Two-dimensional electrophoresis is a technique that combines \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_ to obtains very high resolution separation of proteins.
    1. SDS-PAGE; Isoelectric focusing
    2. Affinity chromatography; Column chromatography
    3. Isoelectric focusing; High pressure liquid chromatography
    4. Dialysis; Affinity chromatography
    5. Column chromatography; SDS-PAGE
43. Choose the correct statement.
    1. Mesenchymal cells cannot divide.
    2. Hypertrophic obesity is more serious than hypercellular obesity.
    3. The function of plasma cells is to store mediators of inflammatory response.
    4. Associated cells are always surrounded by epithelial tissue, but may or may not be surrounded by connective tissue.
    5. Collagen is the most abundant protein in the body.
44. Which type of collagen is responsible for providing a delicate support meshwork?
    1. Type I
    2. Type II
    3. Type III
    4. Type IV
45. What disease is caused by a deficiency in the answer to #39?
    1. Kartagener’s Syndrome
    2. Scurvy
    3. Ehlers-Danlos Type IV
    4. Ehlers-Danlose Type VII
    5. Emphysema
46. What disease is caused by a change in the enzyme procollagen peptidase, and results in the patient having hyperflexible joints and soft skin?
    1. Kartagener’s Syndrome
    2. Scurvy
    3. Ehlers-Danlos Type IV
    4. Ehlers-Danlose Type VII
    5. Emphysema
47. Marfan’s Syndrome is a disease that results from a problem with
    1. Elastic fibers
    2. Collagen fibers
    3. Mast cells
    4. Reticular fibers
    5. Wandering cells
48. Choose the correct statement regarding ground substance.
    1. Hyaluronic acid is a sulfated glucosaminoglycan.
    2. Heparin sulfate is a sulfated glucosaminoglycan that is located in cartilage.
    3. Syndecan is a free proteoglycan, while perlacan is a transmembrane proteoglycan.
    4. Laminin is a glycoprotein that binds to heparin sulfate.
    5. Myxedema, or “mucous Edema,” results from a lack of production of GAG’s (glucosaminoglycans) during hypothyroidism.
49. Which statement is true regarding the structures of myoglobin and hemoglobin?
    1. Hemoglobin is a monomer, while myoglobin is a tetramer.
    2. Both hemoglobin and myoglobin have a single O2 site in their structures.
    3. Hemoglobin contains a heme group in the center, but myoglobin does not.
    4. Both hemoglobin and myoglobin have a four O2 sites.
    5. Hemoglobin is a tetramer, while myoglobin is a monomer.
50. The Hill Equation can be useful to describe the binding of a ligand to multiple sited on the protein. Which of these is true about n, the Hill Coefficient?
    1. There is positive cooperativity when n=1
    2. There is negative cooperativity when n>1
    3. There is positive cooperativity when n>1
    4. There is no cooperativity when n<1
    5. The value of n corresponds to the maximum number of sites.
51. One major difference between the Koshland Sequential Model and the Monod Model for Cooperativity is that, unlike the Monod Model, the Koshland Model
    1. Is useful for explaining negative cooperativity
    2. Is useful for explaining positive cooperativity
    3. Does not require symmetry
    4. A and C are correct
    5. A, B, and C are correct
52. “The more oxygenated blood is, the lower its capacity for carbon dioxide.” This statement describes the
    1. Bohr Effect
    2. Haldane Effect
    3. Monod Model
    4. Koshland Model
    5. Hill Coefficient
53. The T state must be stabilized in order for deoxygenated hemoglobin to be able to effectively carry CO2. This stabilization occurs with the formation of a salt bridge between residues of which two amino acids?
    1. Arginine and Valine
    2. Valine and Histidine
    3. Proline and Arginine
    4. Leucine and Glycine
    5. Histidine and Arginine
54. Increasing the concentration of which of these will result in a decreased affinity of hemoglobin for oxygen?
    1. CO2 and H+, but not 2,3-BPG
    2. CO2 but not H+ or 2,3-BPG
    3. 2,3-BPG and H+, but not CO2
    4. CO2 and 2,3-BPG, but not H+
    5. CO2, H+, and 2,3-BPG.
55. Which statement is false about carbon monoxide (CO) binding to oxygen?
    1. This binding is irreversible.
    2. CO binds to the O2 binding site with an affinity that is approximately 200 times greater than that of oxygen.
    3. 50% saturation with CO is likely fatal.
    4. CO binding causes Hb to be trapped in a high affinity state.
    5. CO inhibits O2 delivery.
56. Which of these describes the mutation that causes Sickle Cell Disease?
    1. Glu🡪Lys
    2. Val🡪Glu
    3. Pro🡪Lys
    4. Glu🡪Val
    5. Lys🡪Val
57. Which of these steps of the TCA cycle results in the formation of an NADH molecule?
    1. Succinyl CoA to Succinate
    2. Isocitrate to α-Ketoglutarate
    3. Succinate to Fumarate
    4. α-Ketoglutarate to Succinyl CoA
    5. Acetyl-CoA and Oxaloacetate to Citrate
58. Which intermediate of the TCA cycle can serve as a precursor for the synthesis of heme?
    1. α-Ketoglutarate
    2. Oxaloacetate
    3. Succinyl CoA
    4. Fumarate
    5. Malate
59. Which of these is not a dicarboxylic acid that participates in the TCA cycle?
    1. Isocitrate
    2. Fumarate
    3. α-Ketoglutarate
    4. Oxaloacetate
    5. Succinate
60. Choose the correct statement about cell motility.
    1. Most cell-to-cell adhesion involves integrin.
    2. Most cell-to-matrix adhesion involves cadherin.
    3. Diapedesis describes the migration of a cell through the vessel wall.
    4. Platelet activating factor (PAF) is produced during the “trapping” step of extravasation.
    5. Leukocyte Adhesion Deficiency is caused by improperly produced integrin.
61. Choose the **Incorrect** statement about integrin.
    1. It is a transmembrane protein.
    2. It consists of 8 types of α subunits and 14 types of β subunits.
    3. It is a cell surface adhesion molecule.
    4. Its α5β1 subunit binds to fibronectin.
    5. Glanzmann’s disease results from excessive bleeding due to a lack of β3 integrin.
62. During which phase of mitosis do the kinetochore microtubules attach sister chromatids to opposite poles of the spindle?
    1. Prophase
    2. Pro-metaphase
    3. Metaphase
    4. Anaphase
    5. Telophase
63. Choose the correct statement about RB and p53.
    1. RB inhibits the cell cycle, but p53 does not.
    2. Li-Fraumeni syndrome is caused by mutations in RB.
    3. Phosphorylation inactivates RB.
    4. P53 inhibits the cell cycle, but RB does not.
    5. RB is the most commonly mutated gene in cancer.
64. Which statement is true about the mechanism of RNAse?
    1. It involves a cyclic phosphate intermediate.
    2. Lys41 acts as a catalyst.
    3. His12 stabilizes the negative charge on the phosphate.
    4. RNAse does not recognize cytosine.
    5. RNAse is generally a very unstable enzyme.
65. Choose the correct statement about serine proteases.
    1. Trypsin cleaves at hydrophobic residues
    2. Chymotrypsin is not a serine protease
    3. Elastase cleaves at lysyl residues
    4. Elastase would be expected to cleave at small, aliphatic residues
    5. Chymotrypsin would be expected to cleave at the N-terminal side of hydrophobic residues.
66. Riboflavin is a vitamin that generally participates in what type of reaction?
    1. Group transfer
    2. Proton transfer
    3. Carboxyl transfer
    4. Acyl-group transfer
    5. One-carbon reaction
67. Competitive enzyme inhibitors:
    1. Increase both Km and Vmax
    2. Increase Km but decrease Vmax
    3. Increase Vmax but decrease Km
    4. Decrease both Vmax and Km
    5. None of the above
68. Noncompetitive inhibitors:
    1. Usually resemble the substrate in question, unlike competitive inhibitors
    2. Can be overcome by increasing substrate concentrations.
    3. Lower Vmax
    4. Increase Km in simple unireactant systems.
    5. Never resemble cosubstrates in multireactant systems.
69. Which statement is **false** about the electron transport chain and oxidative phosphorylation?
    1. Inhibition of electron transport results in decreased oxygen consumption.
    2. CoQ is a lipid soluble compound in the electron transport system that accepts hydrogens from FADH2.
    3. Cytochrome oxidase is the enzyme that synthesizes ATP in the electron transport chain.
    4. Oligomycin inhibits ATP synthesis in mitochondria.
    5. Substrate-level phosphorylation occurs in the cytoplasm.
70. Consider the half-reactions:

Pyr+2H++2e-🡪Lactate; E01= - 0.19V

NAD++2H++2e-🡪NADH; E01= - 0.32V

Calculate ∆E01 for this reaction.

1. 0.13V
2. -0.13V
3. -0.51V
4. 0.51V
5. 0V.